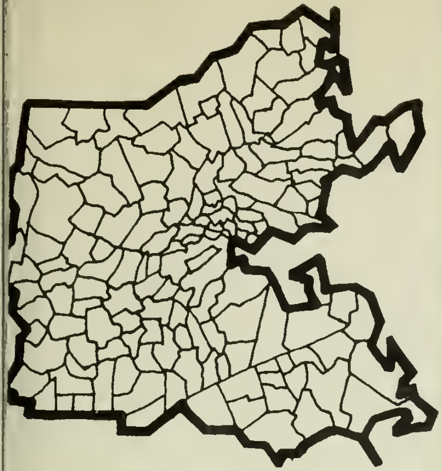
OMNIVM LVX CIVIVM
MDCCCLII
MDCCCLXXVIII

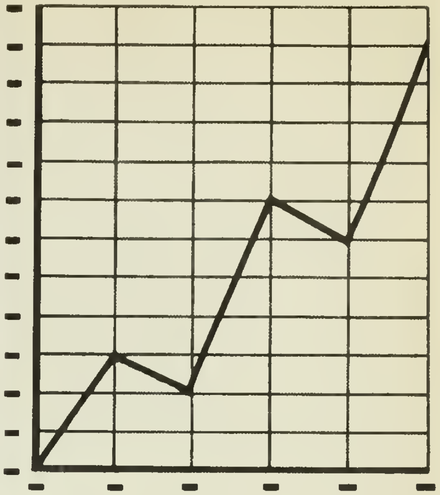
BOSTON
PUBLIC
LIBRARY

Digitized by the Internet Archive
in 2013

http://archive.org/details/economicbasepopu02mass



EASTERN MASSACHUSETTS REGIONAL PLANNING PROJECT



ECONOMIC BASE AND POPULATION STUDY

VOLUME II

PROSPECTS FOR ECONOMIC GROWTH

EPARED BY
METROPOLITAN AREA PLANNING COUNCIL

COOPERATION WITH
MASSACHUSETTS DEPARTMENT OF COMMERCE AND DEVELOPMENT
MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS • MASSACHUSETTS BAY TRANSPORTATION AUTHORITY

Massachusetts. Metropolitan Area Planning Council.
||

ECONOMIC BASE AND POPULATION STUDY
for
EASTERN MASSACHUSETTS

VOLUME II

Prospects for Economic Growth

HC 107
.M4A 548
v. 2

GL

Commonwealth of Massachusetts
METROPOLITAN AREA PLANNING COUNCIL

in cooperation with

Massachusetts Department of Commerce & Development
Massachusetts Bay Transportation Authority
Massachusetts Department of Public Works

and with the

Urban Renewal Administration
U. S. Department of Housing and Urban Development
Bureau of Public Roads
U. S. Department of Commerce
through the
Eastern Massachusetts Regional Planning Project

The preparation of this report was financially aided through a Federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended.

TABLE OF CONTENTS

SUMMARY OF FINDINGS & CONCLUSIONS i

CHAPTER I, Regional Output 1
    National Market Industries 3
    Local Market Industries 8

CHAPTER II, Productivity 10

CHAPTER III, Income and Consumer Expenditures 15
    Personal Income 15
    Consumer Expenditures 18

CHAPTER IV, Employment Trends 21
    Manufacturing Employment 21
    Non-manufacturing Employment 27
    Geographic Distribution of Employment 30

CHAPTER V, Manpower 32
    Shifts in a Tight Market 32
    Will the Region's Labor Supply be Sufficient? 38
    Policy Recommendations 40

CHAPTER VI, Employment Growth by Industry 43
    Manufacturing 46
    Non-manufacturing 50

CHAPTER VII, Development Opportunities 55

STATEMENT OF METHOD supplement

SUMMARY OF FINDINGS AND CONCLUSIONS

GENERAL

The post-war changes in the structure of the Region's economy will enable it to realize high levels of economic growth and prosperity over the next 35 years. These prospects can occur despite increasing competition from other metropolitan areas and geographic shifts in population and consumer markets. However, the Planning Area must maintain and improve upon the quality of its human and technical resources, if the projections are to be realized.

National growth will continue to be transmitted to the Region through industries serving primarily national markets. These industries will account for about one-third of gross regional product and between 34 and 35-percent of total employment.

Science-oriented industries, medical and educational services, and strong financial and insurance institutions will continue to contribute to the high growth of the

future. The Region will continue to be dependent upon industries providing goods or services for national defense, space and oceanographic programs for about 12-percent of its output between now and the year 2000.

Real output and personal income in the Region is expected to more than triple by the year 2000. Employment on the other hand will increase only half again, as a result of a doubling in the output per worker.

INCOME

The standard of living will rise dramatically. However, the rate of increase over the next 35 years will be no greater than that which occurred during the previous 35 years. Per capita real personal income will more than double, as population increases by only 60-percent.

Families earning over $10,000 will account for two-thirds of all families by 1990, in contrast to only 18-percent in 1960. Much of this dramatic rise in family income will be due to large numbers of working wives, or other working members beside the family head. Nationally in 1965, for example, 40-percent of all families earning between $15,000 and $25,000 had a wife working.

Consumer outlays on food, clothing, and housing will grow absolutely but are expected to decline in relative importance. A rising level of discretionary income can be expected to bring about substantial, perhaps dramatic, changes in attitudes toward housing style and quality and its location; in ownership of second houses for weekend and vacation purposes; in the number of multiple car owning families; in the demand for recreation facilities and equipment; in the demand for and nature of public services; and so forth.

EMPLOYMENT AND OCCUPATION

Manufacturing employment will increase 32-percent over the projection period, in sharp contrast to the 8-percent decline experienced between 1947-63. Post-war shifts in the relative importance of individual industries will account for the projected turn-around in the employment trend. Thus, durable goods industries will account for 80-percent of the growth in manufacturing employment. As a result, manufacturing may show somewhat more instability, since durable goods industries are more sensitive to cyclical fluctuations than are nondurables.

Five industry groups (electrical machinery, non-electrical machinery, leather, food, apparel) accounted for slightly over half of the Region's manufacturing

employment in 1963. By 1980, the five leading groups will account for 53-percent and by the year 2000 for 61-percent of all manufacturing employment.

There will be a change in the industry groups dominating employment opportunities in manufacturing. Of the five dominant industry groups in 1963, only two, electrical machinery and non-electrical machinery, were durable goods manufactures. By 1980, durable goods manufacturers will account for four of the dominant industry groups.

Location: In general, industries comprising the dominant groups are "footloose", having no strong factors controlling their choice of location within the Region. With some exceptions, this is also true for other manufacturing industries.

However, the location of manufacturers is of utmost public concern as it affects the functioning of facilities like highways and interchanges; the need for new or enlarged sewer and water facilities; job opportunities for semi and unskilled workers; job opportunities for young adults living at home or working wives; the amount and location of land which should be zoned for industrial purposes and the compatibility of manufacturing to adjacent or nearby land uses. To date, little concern has been

evidenced within the Region about the appropriate location of additional industrial land. Present zoning is excessive in relation to probable future needs. and all too frequently fails to consider the suitability of the land for industrial development.

Non-Manufacturing Employment: The absolute increase in non-manufacturing employment will be nearly three times that in manufacturing. About 17-percent of the increase over the projection period will be accounted for by retailing; another 17-percent will be in medical and educational services; and about 16-percent of the additional employment will be absorbed by federal, state and local government activities.

Much of the employment increase in medical services and universities and colleges is expected to occur at present locations. This implies a substantial expansion in facilities. Since most of these institutions are located in a relatively few communities like Boston and Cambridge, urban renewal may well have to be used on an expanded scale to permit the growth of these important components of the economy.

Other non-manufacturing activities primarily are influenced in their choice of location by the distribution of population. It is expected that a number of

new shopping centers and commercial complexes will be developed in suburban locations. Other than concern about highway locations as expressed through commercial strip-zoning, little real thought appears to have been given to the location of and proper zoning for the host of non-manufacturing activities which account for most of the Region's employment growth.

Labor Market Changes: High employment growth rates between 1963 and 1980 combined with a relatively slower increase in the supply of labor will create a very tight labor market condition during this 17-year period. Such a situation combined with changes in the industrial mix and changes in the importance of occupations within each industry will create manpower shortages in various professional, technical, clerical and skilled craft occupations.

Changes in the age-sex structure of the labor supply also may well result in a severe shortage of experienced men in middle management positions. Between 1963 and 1980, there will be an absolute decline in the number of men aged 25 years and over up through the early 70's and from then on only a modest increase until 1980. This is the age group containing essential know-how and experience. On the other hand, youth and young adults

of both sexes under 25 years of age and women aged 25 and over will account for 83-percent of the increase in the labor supply during this time period.

To meet the prospective shortage in many professional, technical and clerical occupations, women either entering for the first time or reentering the labor force, should be directed into many of the shortage occupations. This could be done through formal training programs, more systematic on-job training, and refresher courses for technically trained women who have been out of the labor force for several years.

Age and racial discrimination need to be overcome through strict law enforcement and programs of personal contact and persuasion. Remediable ills, disabilities or lack of skills or motivation need to be overcome through a combination of skill training and social case-work-health service programs.

For some youth, such a combination program might well take place in small, scattered-site, tutorial, residential urban job centers located within a convenient and inexpensive commute to employers who could provide on-job training. Expansion of work-school programs also would help improve motivation, and make more meaningful the need for education as it relates to the World-of-Work.

For adults and older persons such a program might well take place in Opportunities Industrialization Centers or Workshop training centers patterned after those existing in Philadelphia, or in comprehensive neighborhood centers like those being established by ABCD.

To prevent withdrawal from the labor force and to prevent job-stress situations which inhibit upward occupational mobility of those holding jobs, on-job mental health, social case work and physical health services could be instituted. Several of the Region's large, progressive companies have instituted such programs. for their employes.

Employment in government, education and medical services is expected to grow faster than total employment. An extremely large share of the demand for professional, and technical personnel will occur in these three human service activities. During the decade of the Sixties, alone, there will be a need to replace over 22-percent of those professionals working in human services fields in 1960. To meet this personnel need will require a multi-pronged approach involving better pay scales, better recruitment and personnel development programs, and within the medical field increased opportunities for upward occupational mobility through changes in

attitudes and personnel administration practices involving evaluation of job tasks and staffing requirements.

New Markets and Development Opportunities: Many new markets and industries are anticipated. Many of these developments will center around areas of information and communication, research and development and health and education. These existing and emerging developments will offer increased expansion opportunities for the Region in its areas of present strength. Recent studies indicate that the lone inventor or very small companies are the ones which most frequently discover new products or technologies. Large companies all too frequently only contribute modifications. Again, the process of invention is a strong feature of the Region.

It is important, however, that the Region take better advantage of its scientific and technological resources and the new market and development opportunities. Two major programs ought to be considered in order to insure that the Region takes full advantage of all resources and opportunities. First, consideration should be given to creating a private or quasi-public Regional Development Corporation. Second, consideration should be given to establishing a governmental one-stop service for business patterned after that in New York City.

In general, a Regional Development Corporation would identify specific expansion opportunities, provide coordination among local development corporations, and offer technical, management and training assistance to new and small firms in the Region. For example, one such agency, the Southeastern Pennsylvania Development Corporation (SPEDCO), conducted market studies which led to the funding of new businesses producing such products as pollution control devices and to the development and private funding of several small-scale apparel manufacturing centers. It also assisted in manpower training to meet the expanded needs resulting from these centers.

Aided by Federal grants available through the Small Business Administration, the Economic Development Administration, or the State Technical Services Program (administered for the Federal Government by the University of Massachusetts, Amherst), a RDC could provide product research and advanced planning as well as management advisory services and pooled data processing and clerical services. Such an organization would make possible a more effective industrial promotion and recruitment program and could help improve communications with Federal agencies and with the Region's legis-

lative delegations.

A Development Fund for the purpose of providing high risk equity loans not available from conventional sources is an important adjunct to an RDC. Such a source of risk capital can substantially reduce the difficulties small businesses encounter in their efforts to become established. The Massachusetts Business Development Corporation, a private corporation established in 1953, is just such a source of risk capital. Borrowing from its "members" at one quarter of one percent, the MBDC lends to local development corporations or to private firms at rates ranging from six and three-quarters to seven and three-quarters percent.

Action-Research Program: Indications of a tight labor market, manpower shortages and needs for training, development opportunities, continued suburbanization of employment, the need for more or expanded public services, inadequate concern for the location pattern of industry and commerce have been suggested in this report. Each of these factors would appear to need immediate attention and programs. To do this a series of additional studies such as the following should be considered:

1. Detailed study of employment requirements by industry and occupation to determine education and

training requirements in the Region;

2. Development of manpower policies, programs, and projects including recommendations for wider coordination among the many organizations operating in this field and a review of the appropriate roles of each;

3. An in-depth study of development opportunities resulting from new technology (see Chapter VII) along with formulation of programs to foster this development;

4. Identification of public services and facilities needed to achieve target growth with cost estimates and recommendations for financing;

5. Study of public costs and revenues associated with various industries under alternative local tax structures to determine an advantageous composite of industries;

6. Study of industrial and commercial site, location, access and utility requirements with recommendations for renewal, rehabilitation and/or a land bank of surplus publically-owned lands;

7. Formulation of programs for development, such as industrial financing, publically-sponsored speculative industrial building, and systematic preparation and distribution of technical and management information useful especially to new or small firms.

If a Regional Development Corporation should be established it would be extremely desirable that there be established a formal, cooperative relationship between the proposed Corporation and the Massachusetts Business Development Corporation. Together the two agencies could make significant progress in strengthening one of the weak links in the programs designed to promote economic growth.

GOVERNMENT "ONE STOP SERVICE"

Establishment of a one-stop" information and advice service within each of the regional planning agencies existing in the Area would be most useful. Such an office might provide a range of information useful especially to new and small businesses interested in locating in the Planning Area or in expanding their existing facilities. Included should be information on zoning, building codes, sewer and water problems, wage rates, fuel and energy costs and availability, vacant office space, industrial sites, local State, and Federal aids, sources of private funds such as the MBDC and other topics of interest to small businesses.

I

REGIONAL OUTPUT

By the year 2000, real Gross Regional Product (GRP) is expected to be around $32-billion, more than triple the Region's 1963 output of $9.8 billion. This means that between 1963 and 2000 the Region's output will grow at about 82-percent of the rate anticipated for the nation. Although this will continue the decline in the Region's share of national output, it is an improvement over the Region's performance between 1947 and 1963.(1)

The most rapid growth is expected between 1970 and 1980 (3.52 percent annually), when Gross National Product is expected to reach an annual growth of 4.15 percent. After 1980, annual growth in GNP is expected to drop to 3.75 percent.

---

(1) Of the 41 industry groups analyzed, eight are expected to increase in share of national output produced. These are: miscellaneous chemicals; miscellaneous plastics; leather goods; aircraft and parts; shipbuilding and related; jewelry and related; and toys, amusements, sporting and athletic goods.

TABLE 1

Gross Regional Product By Manufacturing and Non-Manufacturing 1963, 1970, 1980, 1990, 2000

	1963	1970	1980	1990	2000
		(millions of 1960 dollars)			
Regional Product	9,786.9	12,067.0	17,049.6	23,263.1	31,836.6
Mfg.	3,402.5	4,155.2	5,694.9	7,482.5	9,857.4
Nondurable	1,585.4	1,907.9	2,434.4	3,158.3	3,972.3
Durable	1,817.1	2,247.3	3,260.6	4,324.2	5,885.1
Non-Mfg.	6,384.5	7,911.8	11,354.7	15,780.6	21,979.2
Percent Mfg.	34.8	34.4	33.4	32.2	31.0

Detail may not add to totals due to rounding.

TABLE 2

Growth in GRP and GNP, 1947 to 2000

	cumulative annual rate					
	1947-1963	1963-1970	1970-1980	1980-1990	1990 2000	1963-2000
GRP	2.74	3.04	3.52	3.25	3.21	3.24
GNP	3.55	4.15	4.15	3.75	3.75	3.93

TABLE 3

Percent of GNP Accounted for by the Planning Area, Selected Years 1947-2000

1947	1955	1963	1970	1980	1990	2000
1.97	1.75	1.74	1.61	1.52	1.43	1.36

Manufacturing industries will account for a diminishing share of the Region's total output, as a result of the more rapid growth in non-manufacturing industries. Manufacturing will decline from 34.8 percent of total output in 1963 to 31.0 percent in 2000 (see Table 1).

Among manufacturing industries, nondurable goods industries (e.g., food, textiles, rubber) will become less important (see Table 1). Nondurables accounted for some 47-percent of manufacturing output in 1963, but will account for only 43-percent by 1980 and 40-percent by 2000.

NATIONAL MARKET INDUSTRIES

Until 1980 industries which sell primarily in national markets (export industries) are expected to grow slightly faster than those selling almost entirely in local markets. After 1980 this should reverse. The share of total output accounted for by national market industries will increase from 33.1 percent in 1963 to 34.0 percent by 1980, declining gradually thereafter to 32.7 percent by the year 2000.

Manufacturing industries accounted for approximately 74-percent of the Region's total export activity in 1963. They are expected to drop to 71-percent by 1980 and to 70-percent by 2000. Despite this declining share, the

national market manufacturing industries will continue to grow, increasing by approximately 22-percent between 1963 and 1970, and by 41-percent between 1970 and 1980.

TABLE 4

National Market Gross Product
by Manufacturing and Non-Manufacturing
1963, 1970, 1980, 1990, 2000

	1963	1970	1980	1990	2000
			(millions of 1960 dollars)		
National Market	3238.8	4016.0	5789.7	7802.6	10396.8
Manufacturing	2403.2	2934.1	4130.2	5495.1	7232.9
Non-Manufacturing	835.6	1081.9	1659.5	2307.5	3163.9
			(percent distribution)		
National Market	100.0	100.0	100.0	100.0	100.0
Mfg.	74.2	73.1	71.3	70.4	69.6
Non-Mfg.	25.8	26.9	28.7	29.6	30.4
National Market as Percent of GRP	33.1	33.3	34.0	33.5	32.7

Defense-Oriented Industries: The output of industries relying heavily upon expenditures related directly or indirectly to national defense will increase significantly over the projection period.(2) This growth will be especially high (78.1 percent) from 1963 to 1980. While growth will continue after 1980, the output of these industries will be a somewhat declining proportion of GRP after that year.

---

(2) Defense-oriented industries are: electrical machinery, transportation equipment, instruments, miscellaneous services, and Federal civilian defense.

TABLE 5

Output in Defense-Oriented Industries
Planning Area, 1963, 1970, 1980, 1990, 2000

	1963	1970	1980	1990	2000
	(millions of 1960 dollars)				
Gross Product of Defense Industries	1230.5	1454.3	2191.5	2872.8	3858.5
Percent of GRP	12.6	12.1	12.9	12.3	12.1

Key Manufacturing Industries: In 1963, 55-percent of the output of national market manufacturing industries was produced by the export industries of five industry groups. Over the projection period national market manufacturing will become somewhat less diversified as the top five industry groups account for 56-percent of total output in 1980 and 58-percent in 2000.

Although their order will vary, the top five industry groups will remain the same after miscellaneous manufacturing replaces transportation equipment around 1970. Electrical machinery will continue to be the biggest export.

TABLE 6

Top Five Manufacturing Export Groups(3)
1963, 1980, 2000

	Distribution of Gross Product					
	1963		1980		2000	
Industry Group	Rank	%	Rank	%	Rank	%
Rubber	4	7.5	5	7.4	4	9.1
Non-Elect. Mach.	2	12.3	3	9.0	5	8.4
Elect. Mach.	1	19.9	1	20.4	1	18.5
Trans. Equipment	5	7.0				
Instruments	3	8.1	4	8.6	2	11.4
Misc. Mfg.			2	10.9	3	10.0
All other Mfg. Export		45.1		43.6		41.7
TOTAL		100.0		100.0		100.0

Key Non-Manufacturing Industries: Five non-manufacturing groups were identified as national market-oriented. Unlike manufacturing, all components of these industry groups are export-oriented.

Insurance carriers have been and will probably continue to be the most important of the non-manufacturing export industries. Miscellaneous services, which ranked fifth in 1963, is projected to be third by 1980, and second by the year 2000. This industry group is closely allied to science-based industries, which are expected to show dramatic gains in the coming years.

---

(3) Only export components of the industry groups are included. Instruments manufacturing is entirely export-oriented and over 99-percent of all rubber production is for export, but others of the top five industry groups contain significant local market components. Together the export components account for 86, 87, and 84-percent of the total output of these five groups in 1963, 1980, and 2000 respectively.

The Federal civilian defense industry, while increasing its output over the projection period, is expected to decline significantly in importance.

TABLE 7

Gross Product of Major Non-Manufacturing Export Industries 1963, 1980, 2000

	1963		1980		2000	
Industry	Rank	%	Rank	%	Rank	%
Insurance Carriers	1	30.1	1	28.7	1	32.8
Medical Services	4	15.2	4	16.3	4	15.0
Private Education	2	21.7	2	21.7	3	20.0
Misc. Business Serv.	5	15.2	3	20.4	2	24.4
Fed. Civilian Def.	3	17.8	5	12.8	5	7.7
TOTAL		100.0		100.0		100.0

Tourism: An export activity which has not been mentioned in this study is the "tourist industry." Visitors to the Region make an important contribution to the economy, especially in certain cities and towns which not only serve large numbers of non-resident businessmen and conventions but also are in themselves "tourist attractions." In the projections, this activity is accounted for by the industries serving tourists (e.g., lodging facilities and retail trade). The difficulties in measuring tourist expenditures, however, are enormous.

One recent attempt to measure tourist expenditures in Massachusetts was undertaken for the Massachusetts

Department of Commerce and Development.(4) These are provisional estimates, presented here only as suggestive of the magnitude of the tourist industry.

TABLE 8

Provisional Estimates of Tourist Expenditures
In Massachusetts, 1954, 1958, 1963

	(millions of current dollars) 1954	 1958	 1963
All Tourists	$593.0	$755.7	$1066.5
Non-Business Travelers	511.0	655.0	932.0
Business and Convention	82.0	100.7	134.5

SOURCE: Measurement of Tourism in Massachusetts, Urban Survey Corporation, December, 1962.

As indicated in this study, business and convention trade has been a relatively small portion (13-per cent in 1963) of total tourist expenditures. With the availability of modern convention facilities in the city of Boston, this part of the tourist industry should grow rapidly.

LOCAL MARKET INDUSTRIES

Those industry groups producing primarily for sale within the Planning Area are projected to grow by approximately 72-percent between 1963 and 1980, and by another 90-percent between 1980 and 2000.

---

(4) Measurement of Tourism in Massachusetts, Urban Survey Corporation, Cambridge, Mass. for the Busnick Company, Boston, Mass. in connection with their work for and with the approval of the Div. of Tourism, Dept. of Commerce and Development, Commonwealth of Massachusetts, December 1965.

Non-manufacturing will account for over 80-percent of all local market output in each decade of the projection period. Among the more important local market non-manufacturing industries are those in the trade, finance, real estate, government, and services groups.

Among the more important local market manufacturing industries are those in the food, printing, and non-electrical machinery groups.

TABLE 9

Local Market Gross Product
by Manufacturing and Non-Manufacturing
1963, 1970, 1980, 1990, 2000

	1963	1970	1980	1990	2000
	(millions of 1960 dollars)				
Local Market GP	6548.2	8050.9	11260.0	15460.4	21439.8
Manufacturing	999.3	1221.0	1564.8	1987.4	2624.5
Non-Manufacturing	5548.9	6829.9	9695.2	13473.0	18815.3
	(percent distribution)				
Local Market GP	100.0	100.0	100.0	100.0	100.0
Percent Mfg.	15.3	15.2	13.9	12.9	12.2
Percent Non-Mfg.	84.7	84.8	86.1	87.1	87.8
Local Market as Percent of GRP	66.9	66.7	66.0	66.5	67.3

II

PRODUCTIVITY

With some exceptions, output per worker has been lower in the Planning Area than it has been in the United States in Postwar years. (5) However, productivity has and will continue to grow rapidly both regionally and nationally. In both manufacturing and non-manufacturing, the real value of output per worker in the Region will more than double before the end of the century.

TABLE 10

Output Per Worker by Manufacturing and Non-Manufacturing Planning Area, 1963, 1970, 1980, 1990, 2000

	(1960 dollars)				
	1963	1970	1980	1990	2000
All Industries	7,619	8,711	10,537	12,916	15,794
Manufacturing	8,636	10,189	12,661	15,631	18,924
Non-Manufacturing	7,169	8,094	9,719	11,933	14,704

Productivity will grow faster in manufacturing industries (47-percent)than it will in non-manufacturing industries (28-percent) between 1963 and 1980. But the difference will narrow after 1980.

---

(5) Volume I of this report presented a comparison of output per worker in the Planning Area with that in the United States from 1947 to 1963

Among manufacturing industries productivity is expected to grow especially rapidly in the following groups: chemicals, rubber, transportation equipment, instruments, and miscellaneous manufacturing (see Table 11).

Among non-manufacturing industries, the greatest rise is expected in the transportation-communications-utilities industry group, where output per worker will more than triple. Historically, this category has shown remarkable gains in productivity. Improved methods of production combined with higher capital-to-worker ratios should allow this rapid growth to continue.

Output per worker in mining, construction and trade will more than double by the end of the century. More imaginative approaches to development along with more extensive use of capital equipment in the construction of buildings and highways can be expected to boost productivity. Both wholesale and retail distribution will also change dramatically in the next forty years, including development of completely automated retail outlets.

In other industries, increases in productivity will result from more intensive use of capital, from scientific advances in work rationalization, and from

TABLE 11

Output Per Worker as a Ratio of 1963 Output Per Worker for Selected Industries in the Planning Area 1963, 1970, 1980, 1990, 2000

	Output per Worker 1963	Output per Worker as a ratio of 1963 Output			
		1970	1980	1990	2000
ALL MANUFACTURING	8,636	118	147	181	219
Food & Kindred Products	10,797	103	117	132	162
Tobacco	35,000	---	---	---	---
Textiles	5,967	112	150	199	264
Apparel	5,122	115	158	217	298
Lumber & Wood Products	6,207	116	135	158	185
Furniture & Fixtures	6,340	126	159	201	253
Paper & Allied Products	9,030	113	153	203	218
Printing & Publishing	8,562	104	121	139	156
Chemical Products	13,255	123	166	225	306
Petroleum	8,222	140	181	236	294
Rubber	8,377	129	179	250	348
Leather	5,423	115	147	193	244
Stone, Clay & Glass	9,660	120	157	201	255
Primary Metals	8,362	110	115	107	108
Fabricated Metals	8,090	106	119	134	122
Non-electrical Machinery	9,944	109	132	154	182
Electrical Machinery	8,388	117	136	159	185
Transportation Equipment	13,432	124	167	227	307
Instruments	10,152	119	171	246	357
Miscellaneous Manufacturing	7,241	160	241	341	494
ALL NON-MANUFACTURING	7,619	104	128	157	193
Mining & Construction	7,756	106	125	149	254
Transportation, Commun., & Utilities	13,507	127	182	247	327
Wholesale Trade	11,266	107	135	171	216
Retail Trade	6,583	111	128	167	213
Finance, Insurance & Real Estate	7,989	109	131	157	189
Services	5,298	121	140	164	189
Government	5,108	106	127	148	170

greater use of computers as decision-making tools and as substitutes for much accounting and clerical manpower.

In coming years computers will have far-reaching effects in such fields as finance, health, education, and social research. Mr. George Mitchell, a member of the Board of Governors of the Federal Reserve System, has observed that within the discernible future computers will make cash and checks almost obsolete. Through the use of a nationwide network of computer centers, banks will be able to handle payrolls, analyze corporate finances, pay contractual obligations (mortgages, insurance, rent, etc.), and provide depositors with cash-credit cards. Voice identification similar to fingerprinting will prevent theft and forgery.

Even now, hospital information systems are being installed to reduce the clerical load on doctors and nurses and to speed the flow of information. More important is the effort being made to automate medical testing and examination, which promises to make a program of preventive medicine available for all. For example, there are not nearly enough heart specialists to analyze once-a-year electrocardiograms

for everyone in the population. But computer systems can be designed to review all cases and segregate those requiring medical attention. The National Institute of Health has also been studying the possibility of a national system of computerized medical records containing the medical history of each individual.

Education has many of the same management problems faced by other industries; the use of computers in this field promises far greater productivity than was possible in education in the past.

Computers are also making the design process far more efficient. This combined with computer-controlled production equipment should cut the cost of many custom-designed products enough that more people can afford "to be different."

In addition, the use of computers, both for processing vast quantities of information and for testing models of systems under investigation, promises a major break-through in the social and behavioral sciences.

Growth in productivity has taken many forms. In an earlier decade, power-driven machines boosted productivity. In the current decade, productivity is rising through automation. It is difficult to predict the exact source of new advances in productivity, but we can be reasonably sure they will come.

III

INCOME AND CONSUMER EXPENDITURES

PERSONAL INCOME

Real personal income in the Planning Area will more than triple by the end of the Century, rising from $9.2 billion in 1963 to around $30.4 billion by 2000.(6)

In 1963 the personal income of the average resident of the Planning Area was slightly more than $2600. Projections indicate a 47-percent rise during the next seventeen years, and a similar increase in the subsequent twenty years. If the projections prove valid, per capita personal income will be close to $5700 by 2000. Cumulative annual rates of per capita income growth are expected to be as follows:

1963-1970	1970-1980	1980-1990	1990-2000
2.04%	2.48%	1.93%	1.95%

---

(6) All income estimates in this study are expressed in terms of the purchasing value of the dollar in 1960.

TABLE 12

Total and Per Capita Personal Income Planning Area, 1963, 1970, 1980, 1990, 2000

	Total Personal Income (millions of 1960 dollars)	Per Capita Personal Income(7) (1960 dollars)
1963	9,160	2,625
1970	11,245	3,023
1980	16,106	3,863
1990	22,125	4,675
2000	30,411	5,673

Income Distribution: Where historically the growth of the middle income brackets was the biggest shift in the distribution of incomes, growth of the upper income brackets will be the great shift of the future. In 1960 approximately 18-percent of the Region's families had incomes exceeding $10,000; by 1975, this proportion will have increased to nearly 45-percent. At the same time the upper brackets are expanding, the lower brackets will shrink. In 1960, 38-percent, or arount 377,000, of the Region's families received incomes of less than $5000. By 1975 this figure will probably

---

(7) Based on the population projection reported in Volume III of this study.

drop to about 22-percent, or 230,000 families. The proportion of the Region's families in the $5,000 to $9,999 bracket will also drop.

TABLE 13

Distribution of Families and Unrelated Individuals
by Income Classes, Planning Area
1960, 1975, 1990

(1960 dollars)

	1960		1975		1990	
Income Range	Number	Percent	Number	Percent	Number	Percent
All Incomes	1,007,067	100.0	1,066,300	100.0	1,258,050	100.0
0-4,999	377,261	37.5	229,460	21.5	174,010	13.8
5,000-9,999	446,532	44.3	354,750	33.3	257,760	20.5
10,000-14,999	121,755	12.1	274,590	25.8	302,920	24.1
15,000 and over	61,519	6.1	207,500	19.4	523,360	41.6
Median Income	$6,414	--	$9,280	--	$13,260	--

Based on this projected distribution, the median income of $6414 estimated for 1960 will have increased 50-percent by 1975 ($9,280) and will have more than doubled by 1990 ($13,260).

While it is difficult to draw a precise line between necessary and optional expenditures, the average family probably requires about $7,000 a year to maintain a modest but comfortable standard of living.(8) Income

---

(8) This figure is based on a study of family budgets made by the Bureau of Labor Statistics as reported in "Spending Power in the Seventies", The Conference Board Record, National Industrial Conference Board, Vol. III No. 3, March 1966, p. 46.

in excess of this amount is assumed to be available for optional or discretionary expenditures by the Region's families. As family incomes rise, larger expenditures will be made for food, clothing and shelter, but the proportion of each family's budget spent on these items will diminish. The average family will spend a larger share of its income on items of its own choosing rather than on basic necessities.

CONSUMER EXPENDITURES

Like income, real consumer expenditures in the Region are expected to more than triple by the end of the Century, reaching a level of nearly $24-million by the year 2000.

TABLE 14

Per Household and Per Capita Consumer Expenditures
Planning Area, 1963, 1970, 1980, 1990, 2000

	(1960 dollars)				
	1963	1970	1980	1990	2000
Per Household	7,286	8,712	11,347	13,754	16,357
Per Capita	2,108	2,412	3,047	3,657	4,411

Real expenditures in all major categories will more than double; but the proportion allocated to necessities will decrease substantially (see Table 16). Food, clothing, and housing expenditures will rise from less than five million dollares to nearly $14-million, but they will drop by nearly eight-percent

TABLE 15

Consumer Expenditures by Major Category in the Planning Area 1963, 1980, 2000

Item	(millions of 1960 dollars) 1963	1980	2000	Percent Increase 1963-1980	1980 2000
All Consumer Expend.	7,356	12,702	23,644	72.7	86.1
Food	1,868	2,883	4,398	54.3	52.5
Clothing & Per. Care	831	1,334	2,317	60.5	73.7
Housing	2,104	3,607	6,904	71.4	91.4
Transportation	839	1,461	2,766	74.1	89.3
Recreation	419	800	1,631	90.9	103.9
Medical Expenses	412	788	1,655	91.3	110.0
Other Expenditures	883	1,829	3,972	107.1	117.2

TABLE 16

Percent Distribution of Consumer Expenditures By Major Category, in the Planning Area 1963, 1970, 1980, 1990, 2000

Item	1963	1970	1980	1990	2000
Food	25.4	25.1	22.7	20.7	18.6
Clothing & Personal Care	11.3	11.1	10.5	10.1	9.8
Hous'g, Hsehld Durables and Operation	28.6	28.0	28.4	28.9	29.2
Transportation	11.4	11.4	11.5	11.6	11.7
Recreation	5.7	6.0	6.3	6.6	6.9
Medical Expenses	5.6	5.7	6.2	6.6	7.0
Other Expenditures(9)	12.0	12.7	14.4	15.5	16.8
TOTAL	100.0	100.0	100.0	100.0	100.0

(9) Other expenditures includes education, religious and welfare, personal business and foreign travel expenditures.

as a proportion of total expenditures. And much of the increased expenditures will be for additional or more expensive items, especially in the housing category. Increased investment in household appliances can be expected as well as investment in larger and more comfortable homes. Summer homes will be more common, with additional expenditures for appliances and operation of a second home. The average consumer will buy more expensive cuts of meat, more prepared foods, and more imported or exotic foods.

At the same time, the share of expenditures allocated to medical care, recreation, education, and personal business will increase. Medical expenditures will increase not only because of rising costs but also because the average level of services consumed will rise substantially. The rise in personal business expenditures will reflect the purchase of larger insurance policies and additional financial services. Larger expenditures for recreation and education will reflect not only rising incomes but also a pattern of production which provides more and more leisure for the average citizen.

IV

EMPLOYMENT TRENDS

Employment in the Planning Area is expected to increase by approximately 731,000 between 1963 and 2000.(10) Forty-six percent of this growth is expected before 1980, bringing total employment up to approximately 1.6 million in that year.

MANUFACTURING EMPLOYMENT

Manufacturing employment will increase by about 56,000 between 1963 and 1980, in contrast to a decline of nearly 35,000 from 1947 to 1963. But in spite of this reversal, manufacturing will be a declining share of total employment. In 1963 it accounted for nearly 31-percent of all employment. Faster growth in non-manufacturing employment will reduce this figure to 28-percent of total employment in 1980 and 26-percent in 2000 (see Table 18).

---

(10) All references to regional employment will include only non-agricultural wage and salary workers. This excludes agricultural employment and self-employed individuals, unless otherwise noted.

TABLE 17

Cumulative Annual Rates of Employment Growth
by Manufacturing and Non-Manufacturing
Planning Area 1963-2000

	1963-1970	1970-1980	1980-1990	1990-2000
All Employment	1.08	1.57	1.08	1.13
Manufacturing	.49	.99	.63	.85
Non-Manufacturing	1.34	1.79	1.25	1.23

The Region's manufacturing employment will grow at an annual rate of .49 percent between 1963 and 1970 and .99 percent between 1970 and 1980. Employment in fourteen manufacturing groups will grow between 1963 and 1980. But only nine of these 14 will account for a larger share of total employment in 1980 than they did in 1963.(11) Together these nine will account for 59-percent of all manufacturing employment by 1980, compared with 53-percent in 1963.

Except for three nondurable groups (paper, leather, and petroleum), the more rapidly growing industries will be those producing durable consumer and producer goods. The fabricated metal, miscellaneous manufacturing, and electrical machinery groups should experience the fastest

---

(11) Those industries increasing in share of total manufacturing employment are: furniture; paper; petroleum; leather; stone, clay, glass; fabricated metal; non-electrical machinery; electrical machinery; and miscellaneous manufacturing.

TABLE 18

Employment by Manufacturing and Non-Manufacturing
1963, 1970, 1980, 1990, 2000

	1963		1970		1980		1990		2000	
	000's	%	000's	%	000's	%	000's	%	000's	%
All Employment	1,284.6	100.0	1,385.3	100.0	1,618.1	100.0	1,801.1	100.0	2,015.7	100.0
Manufacturing	394.0	30.7	407.8	29.4	449.8	27.8	478.7	26.6	520.9	25.8
Durable	199.9	(50.7)	207.9	(51.0)	245.6	(54.6)	267.9	(56.0)	302.4	(58.1)
Nondurable	194.1	(49.3)	199.9	(49.0)	204.2	(45.4)	210.7	(44.0)	218.5	(41.9)
Non-Manufacturing	890.6	69.3	977.5	70.6	1,168.3	72.2	1,322.4	73.4	1,494.8	74.2

TABLE 19

Export and Local Market Employment
by Manufacturing and Non-Manufacturing
1963, 1970, 1980, 1990, 2000

	1963	1970	1980	1990	2000
All Export	433.3	470.6	561.6	628.4	706.3
Manufacturing	284.7	292.8	324.5	342.7	365.3
Non-Manufacturing	148.5	177.8	237.1	285.7	341.0
All Local	851.3	914.7	1056.5	1172.6	1309.4
Manufacturing	109.3	115.0	125.3	135.9	155.6
Non-Manufacturing	742.0	799.7	931.2	1036.7	1153.8

Detail may not add to totals due to rounding.

TABLE 20

Manufacturing Employment by Industry Group
1963, 1980, 2000

	1963		1980		2000		
Industry Group	000's	%	000's	%	000's	%	% Change 1963-1980
All Manufacturing	394.0	100.0	449.8	100.0	520.9	100.0	14.2
Food	31.5	8.0	28.4	6.3	24.0	4.6	- 9.8
Tobacco (12)	--	--	--	--	--	--	--
Textiles	18.4	4.7	15.8	3.5	13.6	2.6	-14.1
Apparel	27.8	7.1	29.5	6.6	27.5	5.3	6.1
Lumber	2.9	.7	2.4	.5	3.0	.6	-17.2
Furniture	5.3	1.3	6.7	1.5	8.5	1.6	26.4
Paper	16.5	4.2	20.8	4.6	23.3	4.5	26.1
Printing	27.6	7.0	30.9	6.9	44.3	8.5	12.0
Chemicals	10.6	2.7	11.4	2.5	10.7	2.1	7.5
Petroleum	.9	.2	1.1	.2	.5	.1	22.2
Rubber	21.5	5.5	20.5	4.6	22.6	4.3	- 4.7
Leather	39.2	9.9	45.7	10.2	52.0	10.0	16.6
Stone, Glass	5.3	1.3	6.4	1.4	5.2	1.0	20.8
Primary Metal	6.9	1.8	7.5	1.7	7.6	1.5	8.7
Fabricated Metal	20.0	5.1	31.6	7.0	57.3	11.0	58.0
Non-elec. Mach.	39.5	10.0	45.5	10.1	65.3	12.5	15.2
Electrical Mach.	63.7	16.2	83.6	18.6	98.7	18.9	31.2
Transp. Equip.	16.9	4.3	14.8	3.3	11.8	2.3	-12.4
Instruments	19.1	4.8	20.4	4.5	22.7	4.4	6.8
Misc. Mfg.	20.3	5.2	26.7	5.9	22.3	4.3	31.5

(12) Less than 50 employes and assumed constant.

growth. Between 1963 and 1980, employment in these three industries will increase by 58.0 percent, 31.5 percent, and 31.2 percent respectively (see Table 20).

The greatest employment declines between 1963 and 1980 are anticipated in lumber (-17.2 percent), textiles (-14.2 percent), and transportation equipment (-12.4 percent).

Key Manufacturing Industries: In 1963, approximately 51-percent of the Region's manufacturing employment was concentrated in five industry groups (see Table 21).

TABLE 21

Distribution of Employment among
Five Top-Ranked Manufacturing Groups
1963, 1980, 1990

Industry Group	1963	1980	1990
Electrical Machinery	16.2	18.6	18.9
Non-Electrical Machinery	10.0	10.1	12.5
Leather	9.9	10.2	10.0
Food	8.0	--	--
Apparel	7.1	--	--
Fabricated Metals	--	7.0	11.0
Printing	--	6.9	8.5
All Other Manufacturing	48.8	47.2	39.1
TOTAL	100.0	100.0	100.0

By 1980, the five most important industries will account for almost 53-percent of all manufacturing employment, and by the year 2000 these industries will

account for 61-percent. In spite of this increased concentration in manufacturing employment, the Region's economy is expected to remain adequately diversified. There is no fixed rule by which the optimum degree of diversification may be measured; but one rather widely used "rule of thumb" is that excessive concentration is reached when any single industry group accounts for more than twenty-percent of all employment. Except for electrical machinery, which gained it's first-place rank in 1953, none of the industry groups even approaches this figure.

The Region has been reasonably successful in avoiding violent economic fluctuations during the post-war period. One reason for this has been the importance of nondurable manufacturing in the Region. Since the purchase of nondurable goods is not as readily postponed as the purchase of durable goods, nondurable goods industries are not usually as sensitive to cyclical fluctuations. Nondurables, however, are a declining share of the Region's manufacturing employment, dropping from 63-percent to 49-percent between 1947 and 1963. By 1980, they will account for only 45-percent. As a result, the Region may show somewhat less stability.

National Market Manufacturing Industries: In the decade of the 1970's employment will grow slightly faster in export industries than it will in local market industries. After 1980, however, growth in local market industries will overtake export (see Table 22 below and Table 19 above).

TABLE 22

Employment Growth in Export and Local Market Manufacturing in the Planning Area 1963-2000

	1963-1970	1970-1980	1980-1990	1990-2000	1963-1980
All Manufacturing	3.5	10.3	6.4	8.8	14.2
Export	2.8	10.8	5.6	6.6	14.0
Local	5.2	9.0	8.5	14.5	14.6

NON-MANUFACTURING EMPLOYMENT

Employment in non-manufacturing industries will grow by more than thirty-percent between 1963 and 1980, compared with a rise of only 14-percent in manufacturing. Except for the transportation-communications-utilities group, employment in major non-manufacturing groups will expand by at least twenty-percent during this seventeen-year period. The non-manufacturing industries which can expect the fastest growth are those in finance, insurance, and real estate, and those providing business and professional services.

TABLE 23

Non-Manufacturing Employment by Major Industry Group
Planning Area 1963, 1970, 1980, 1990, 2000

	(in thousands)				
	1963	1970	1980	1990	2000
All Non-Manufacturing	890.6	977.5	1168.3	1322.4	1494.8
Mining & Construction	57.9	64.8	69.6	79.1	64.0
Trans., Comm, & Utl.	76.6	78.3	78.0	79.0	81.8
Wholesale & Retail Trade	283.2	311.8	372.8	397.5	436.6
Finance, Insur. & R. E.	81.3	92.0	121.7	152.3	186.9
Services	210.7	237.5	300.5	362.7	444.6
Government	180.8	193.1	225.7	251.8	280.8

Employment in the transportation-communications-utilities group is expected to grow slowly since new technology continually limits the need for additional workers in this field.

Between 1963 and 1980 employment is expected to drop in only six of 27 non-manufacturing groups. Together these six groups accounted for less than 6-percent of total non-manufacturing employment in 1963 (see Table 24).

National Market Non-Manufacturing Industries: Throughout the projection period employment will grow faster in non-manufacturing industries selling predominately in national markets than it will in those selling predominately in local markets. Between 1963 and 1980 export industries will grow more than twice as fast as local

TABLE 24

Non-Manufacturing Employment by Industry
1963, 1980, 2000

	1963		1980		2000		
Industry Group	000's	%	000's	%	000's	%	% Change 1963-80
All Non-Mfg.	890.6	100.0	1168.3	100.0	1494.8	100.0	31.2
Mining	.6	.1	.6	.1	.5	--	--
Construction	57.3	6.4	69.0	5.9	63.5	4.3	20.4
Railroad Trans.	6.6	.7	3.7	.3	2.2	.1	-44.0
Trans. except R.R.	37.3	4.2	44.0	3.8	49.7	3.3	18.0
Communications	20.9	2.4	21.2	1.8	21.7	1.5	01.4
Public Utilities	11.7	1.3	9.1	.8	8.2	.6	-22.3
Wholesale Trade	74.1	8.3	95.8	8.2	124.7	8.3	29.3
Retail Trade	209.1	23.5	277.0	23.7	311.9	20.9	32.5
Fin.,Real Estate	50.9	5.7	83.1	7.1	141.1	9.4	63.3
Ins. Carriers	30.4	3.4	38.6	3.3	45.8	3.1	27.0
Hotels	8.4	.9	9.7	.8	12.6	.8	15.5
Personal Serv.	21.1	2.4	20.5	1.8	23.3	1.6	- 2.8
Business Serv.	37.3	4.2	43.0	3.7	49.6	3.3	15.3
Repair Serv.	3.0	.3	2.6	.2	3.1	.2	-13.3
Motion Pictures	3.5	.4	3.0	.3	5.1	.3	-14.3
Amusements	6.7	.8	5.2	.4	6.0	.4	-22.4
Medical Services	46.9	5.3	82.9	7.1	119.3	8.0	76.8
Legal Services	4.6	.5	7.6	.7	19.1	1.3	65.2
Private Education	33.8	3.8	52.8	4.5	71.4	4.8	56.2
Vocat'l Schools & Employ. Agencies	1.2	.1	1.5	.1	3.0	.2	25.0
Priv. Elem. & Sec. Education	9.3	1.0	13.5	1.1	19.4	1.3	43.0
Non-Profit Organ.	20.5	2.3	21.6	1.8	28.7	1.9	05.4
Misc. Services	14.5	1.6	36.9	3.2	84.1	5.6	154.5
Federal Civilian Non-Defense	26.9	3.0	33.6	2.9	36.3	2.4	24.9
Federal Civilian Defense	23.0	2.6	26.0	2.2	20.4	1.4	13.0
State Government	34.2	3.8	46.2	4.0	55.8	3.7	35.1
Local Government	96.6	10.9	119.9	10.3	168.3	11.3	24.1

market industries. As a result, the national market's share of total non-manufacturing employment will rise from 16.7 percent in 1963 to 20.3 percent by 1980.(13)

TABLE 25

Rates of Employment Growth in National and Local Market Non-Manufacturing, 1963-2000

	(Percent Change)				
	1963-1970	1970-1980	1980-1990	1990-2000	1963-1980
All Non-Manufacturing	9.8	19.5	13.2	13.0	31.2
Export	19.7	33.4	20.5	19.4	59.7
Local	7.8	16.4	11.3	11.3	25.5

GEOGRAPHIC DISTRIBUTION OF EMPLOYMENT

Employment will not grow uniformly among the Planning Area's subregions (see Table 26). At current rates the Boston SMSA will account for only 79-percent of total wage and salary employment by 1980, compared with 81-percent in 1963. The Boston SMSA's share of manufacturing employment will drop from 70.5 percent to some 66-percent. The Non-SMSA's share will also decline, while the shares of the three smaller SMSAs, most notably Lawrence-Haverhill, will rise.

---

(13) The non-manufacturing industries classified as national market-oriented are: insurance carriers, medical services, private higher education, miscellaneous services, and Federal civilian defense.

Since non-manufacturing activity usually follows the pattern of population change, the proportion of non-manufacturing employment in the Boston SMSA is expected to drop slightly, from 86-percent in 1963 to 84-percent in 1980.

TABLE 26

Manufacturing and Non-Manufacturing Employment by SMSA
1963, 1970, 1980, 2000

	(in thousands)			
	1963	1970	1980	2000
All Manufacturing	349.0	407.8	449.8	520.9
Boston SMSA	277.9	280.2	298.2	313.1
Brockton SMSA	15.2	15.9	18.0	19.3
Law-Hav. SMSA	41.7	49.3	67.5	104.2
Lowell SMSA	20.6	24.5	29.2	40.6
Non-SMSA	38.6	37.9	36.9	43.7
All Non-Manufacturing	890.6	977.5	1,168.3	1,494.8
Boston SMSA	763.9	831.7	982.2	1,222.7
Brockton SMSA	26.0	31.2	40.8	60.3
Law-Hav. SMSA	33.5	38.0	46.2	63.2
Lowell SMSA	26.8	28.4	35.5	49.5
Non-SMSA	40.2	48.2	63.6	99.0

V

MANPOWER

SHIFTS IN A TIGHT MARKET

Between 1960 and 1980 significant changes will take place in the occupational structure of the Region's labor force. Between 1950 and 1960 the number of white-collar workers -- professional, managerial, clerical, ans sales -- grew significantly, while the number of blue-collar workers declined. This was due not only to rapid increases in labor productivity which displaced blue-collar workers in many industries, but also to a shift within the Region toward industries using higher proportions of skilled and professional workers. Similar changes occurring in the distribution of employment between 1960 and 1980 will also reflect not only the shifting skill requirements within industries but also the Region's shift to higher-skilled industries.

TABLE 27

Employment by Occupation Group
Planning Area, 1960 and 1980

Occupation	1960 000's	1960 %	1980 000's	1980 %	Change in 000's	Change in %
Total Employment	1258.1	100.0	1618.1	100.0	360.0	28.6
Prof. & Tech.	184.4	14.7	289.6	17.9	105.2	57.0
Managers, officials, and Proprietors	117.0	9.3	145.6	9.0	28.6	24.4
Clerical Workers	261.9	20.8	356.0	22.0	94.1	35.9
Sales Workers	115.2	9.2	148.9	9.2	33.7	29.3
Craftsmen and Foremen	162.2	12.9	195.8	12.1	33.6	20.7
Operatives	235.8	18.7	255.6	15.8	19.8	8.4
Service Workers	119.5	9.5	158.6	9.8	39.1	32.7
Laborers	41.4	3.3	42.1	2.6	.7	1.7
Other	20.7	1.6	25.9	1.6	5.2	25.1

Unemployment Rates in the Planning Area
1970, 1975, 1980, 1985, 1990

Year	Labor Force	Employment	Rate of Unemployment
	(in thousands)		
1970	1,434.8	1,385.3	3.5
1975	1,549.9	1,506.7	2.8
1980	1,653.4	1,618.1	2.1
1985	1,758.2	1,705.0	3.0
1990	1,881.1	1,801.1	4.3

Projected employment figures (14) suggest a very tight labor market in the Planning Area over most of the projection period. Unemployment figures have not been available for the exact geographic area under study, but estimates for each of the four SMSAs in the Planning Area indicate the Region is currently experiencing a very tight labor market (see Table 29).

TABLE 29

Estimated Average Rates of Unemployment by SMSA
1960-1965

	Percent of Work Force					
SMSA	1960	1961	1962	1963	1964	1965
Boston	4.3	4.9	4.6	4.7	4.7	4.0
Brockton	7.2	7.7	7.6	8.1	7.2	5.1
Lawrence-Haverhill	6.7	7.6	6.2	7.1	7.0	6.6
Lowell	8.6	9.2	8.0	8.5	8.5	8.1

SOURCE: Mass. Division of Employment Security

With about 86-percent of the workforce living in the Boston SMSA, overall unemployment in 1965 was slightly over 4-percent. Personnel men in the Boston area emphasize that the market is especially tight in skilled and supervisory occupations. Electronics-electrical machinery industries have been especially pressed.

---

(14) These figures are based on non-agricultural projections adjusted for multiple job-holding and self-employment.

Employment is expected to rise in all occupational categories listed in Table 26 between 1960 and 1980, but only three categories -- professional-technical, clerical and services -- are expected to rise in share of total employment. Sales workers will maintain their 1960 share. The demand for professional-technical workers is expected to expand by some 105,000 jobs and the demand for clerical workers by around 94,000 jobs.

Sources of New Demand: The increased demand for workers in any one of these occupation groups is due largely to growth in a few industries. Medical services, legal services, private education, and government will account for approximately seventy-percent of the new demand for professional-technical skills. Since a very large share of government workers are professionals in education, health and welfare, the dramatic increase in professional and technical occupations will be primarily in the field of human services. While manufacturing accounts for less than a fifth of the new demand for professional-technical workers, certain industries such as electrical machinery, transportation equipment, and instruments will require substantial numbers of these workers.

Five industries - retail trade; finance, insurance and real estate; business services; medical services; and private education -- will be responsible for some sixty-percent of the new clerical jobs created by 1970. Three-fourths of all new sales jobs will be created by the retail trade industry. Requirements for managers, however, are dispersed among a greater number of industries.

Blue collar jobs (craftsmen, foremen and operatives) will be distributed among a number of manufacturing groups. The greatest need will be in apparel, fabricated metals, electrical machinery, and non-electrical machinery. But construction and wholesale activities will be the major source of jobs for craftsmen.

Manpower Requirements 1960 to 1970: Manpower requirements include replacing former workers as well as filling new jobs. When both are considered, manpower requirements between 1960 and 1970 total some 437,000 workers (see Table 30). Professional-technical jobs are expected to be 43.1 percent of the new demand, much of which will be in human services fields. Second highest new demand will be for clerical workers (26.4 percent), followed by service workers (11.5 percent).

The remaining occupations will claim less than 20-percent of all new jobs.

TABLE 30

New and Replacement Jobs by Occupation Planning Area 1960 to 1970

Occupation	Total	New Demand 000's	New Demand Percent	Replacement 000's	Replacement Percent
All Occupations	437.2	141.2	100.0	296.0	100.0
Professional and Technical	108.5	60.8	43.1	47.7	16.1
Managers, Officials and Proprietors	39.9	4.9	3.5	35.0	11.8
Clerical Workers	123.3	37.3	26.4	86.0	29.1
Sales Workers	34.6	8.1	5.7	26.5	8.9
Craftsmen and Foremen	39.7	12.3	8.7	27.4	9.3
Operatives	41.9	0 (15)	0	41.9	14.2
Service Workers	43.1	16.3	11.5	26.8	9.0
Laborers	.6	0 (15)	0	.6	.2
Others	5.6	1.5	1.1	4.1	1.4

Around 24-percent of all those employed in 1960 will have to be replaced before the end of the decade (see Table 30). In general, the professional and technical; managers, officials, and proprietors; clerical; and sales categories have had replacement rates somewhat higher than average. In part, these high turnover rates reflect the high proportion of women in these occupations.

---

(15) Employment in this category is expected to decline between 1960 and 1970.

WILL THE REGION'S LABOR SUPPLY BE SUFFICIENT

Labor force additions during the twenty years from 1960 to 1980 will come primarily from young adults under the age of 25 years and from adult women. The number of adult men in the labor force is expected to increase by only 53,000 between 1960 and 1980, and will actually decline by 20,000 between 1960 and 1970 (see Table 31).

TABLE 31

Age Composition of the Region's Labor Force
1960, 1970, 1980

(thousands of workers)

Age Group	1960	1970	1980	Change 1960-70	Change 1960-80
Labor Force	1389	1493	1704	104	315
Young Adults Under 25	234	333	404	99	170
Males 25 and over	766	746	819	-20	53
Females 25 and over	389	414	481	25	92

The labor force increase of 104,000 workers expected between 1960 and 1970 falls significantly short of the anticipated new demand for 140,000 workers. Even if the 14,000 workers displaced from operative and laborer jobs can meet the skill requirements of other expanding occupation groups, the anticipated growth in the labor supply will fall short of the new demand. Over the twenty-year period

from 1960 to 1980, the labor force can be expected to increase by only 315,000 workers compared with a growth of 360,000 jobs.

Some 65,700 of the 140,000 new jobs to be filled by 1970 will require professional, technical, or managerial skills. With an increase in the labor force of only 104,000 workers, it is unlikely that these skill requirements will be met fully. High replacement requirements for professional personnel will compound the difficulties. Every effort must be made to prepare new entrants to the labor force to meet not only the changing needs of industry but also the current shortage of teachers, college faculty, nurses, doctors and social workers. The need to replace, during the decade of the Sixties, something over 22-percent of those professionals working in human services fields in 1960, is likely to increase the current shortage in these fields. In general, the low increase in adult males threatens an accute shortage of experienced and skilled professional, technical, and other white collar workers.

POLICY RECOMMENDATIONS

Since a shortage of men over 25 years of age is a problem expected nationally, recruitment outside the Region will be difficult. If the Region can stop the historical out-migration, the number of men over 25 in the labor force will increase by an additional 55,000 by 1980. Achieving this, however, depends upon both providing financial incentives and improving the Region's amenities.

A continuing attempt should also be made to upgrade the skills of the Area's existing labor force and to more fully educate the young people entering the labor force. The Vocational Education Act of 1964, the Higher Education Act of 1965, Title I of the Economic Opportunity Act and the Manpower Development and Training Act offer substantial funds for meeting needs for quality education and training.

In 1960 approximately one-third of the Region's professional and technical jobs were filled by women. Assuming that female participation rates increase significantly, an additional 25,000 women over 25 years of age will enter the workforce between 1960 and 1970, with another 92,000 entering by 1980.

These women should be encouraged to enter professional and technical fields which have previously been dominated by men.

Additional financial incentives may attract retired and other non-working men and women into the labor force. But achievement of these goals will require, in addition to re-training and financial incentives, the elimination of many barriers, including the barrier of discrimination. Age discrimination, for example, often forces early retirement and prevents older displaced workers from re-entering the labor market with new skills. Since the extent to which social, psychological and health problems restrain entry to the labor force is not known, however, any policy to increase participation must be sensitive to new information about these barriers.

Finally, automation may be accelerated to increase labor productivity, thereby alleviate some of the demand for workers. This approach constitutes a two-edged sword, however. While it would make many job requirements more routine, it would also increase the demand for skilled technicians and professionals, already in short supply.

In many industries, particularly human services, searching evaluation of job tasks and staffing requirements will be necessary if the demands for additional and universally available services are to be met. Expansion of supporting personnel to handle simple tasks now performed by professionals can solve much of the problem. In hospitals, for example, job tasks have already been broken down so that many duties once performed by a registered nurse are now performed by licensed practical nurses and nurses' aides. While training is also required for supporting personnel, its duration is far shorter than for the professional.

If the Region is to achieve its potential economic growth, programs must be implemented to evoke the full economic participation not only of those who are willing and able, but also of those who do not currently participate because of remediable ills, disabilities, or lack of motivation. Particular attention must be paid to groups in the population which have not yet been given an opportunity to make their full contributions to the economic and social well-being of the Nation. Only in this way can maximum production be achieved and the worth of the individual be enhanced.(16)

---

(16) See U. S. Department of Labor, Manpower Report No. 10, Unused Manpower: The Nation's Loss (November, 1965).

VI

EMPLOYMENT GROWTH BY INDUSTRY

During the Twentieth Century structures of industry and population in the various regions of the United States have moved toward national averages. Industries have dispersed, creating diversified economies in most metropolitan areas.(17) This has been possible because manufacturing costs, according to John Friedmann, vary among regions by less than ten percent.(18) Studies indicate that for any one manufacturing industry the range in unit costs of production among metropolitan areas is quite narrow. Wage rates may vary by over 100-percent from one metropolitan area to another, but many industries can easily substitute capital for labor. Thus patterns of production may vary but unit costs

---

(17) For a detailed discussion of regional shifts in economic activity see: H. Perloff, E. Dunn, E. Lampard, and R. Muth, Regions, Resources, and Economic Growth, Resources for the Future, Inc. John Hopkins Press, Baltimore, 1960.

(18) John Friedmann, "Regional Development in Post-Industrial Society: Some Policy Considerations", Nations Manpower Revolution, Part 7, Hearings before the Sub-committee on Employment and Manpower of the Committee on Labor and Public Welfare, U. S. Senate, 88th Congress, First Session, October 29, 31, November 6, 7, and 8, 1963, Government Printing Office, Washington, D. C.

remain highly competitive between regions. The bulk of American manufacturing is free to locate almost anywhere.

Of particular importance for the future growth of the Planning Area are industries such as education, research and communications. These industries depend upon a vast array of highly-trained and skilled personnel. Lack of such skilled manpower resources has been noted in other metropolitan areas. A study of the Pittsburgh Region, for example, pointed out that the current shortage of these skills has limited that Region's growth in research, administration, education, communications, and so forth.(19) This key manpower resource, in terms of both size and depth, has been precisely the competitive strength of the Planning Area. However, as already noted, the Region's demand for manpower possessing these skills will rise faster than the projected supply.

In the past, many years of organized and sustained effort were required in order to improve the competitive position of an area's skilled manpower. Today, with

---

(19) The Pittsburgh Regional Planning Association, Region with a Future, Volume 3, Economic Study of the Pittsburgh Region, Pittsburgh, Pa., 1963.

larger numbers of people in college everywhere and increased government expenditures for technical training, skilled manpower can be developed much faster than ever before. The projections are optimistic: they assume the Planning Area will be able to supply the technical and professional manpower required for continued growth and that the Area will continue to be a source of innovations that will give rise to new firms and greater expansion. If it can maintain these competitive strenghts, the Region will maintain satisfactory growth in both manufacturing and non-manufacturing during the projection period. This growth will not be uniform throughout the Region, however, nor will all industry groups contribute to it equally. Projected employment growth between 1963 and 1980 will be discussed in some detail for those industries listed in Table 32.

TABLE 32

Employment in Selected Industry Groups
Planning Area 1963 and 1980

	(000's)		Percent
	1963	1980	Increase
MANUFACTURING			
Paper and Paper Products	16.5	20.8	26.1
Printing and Publishing	27.6	30.9	12.0
Leather Products	39.2	45.7	16.6
Fabricated Metals	20.0	31.6	58.0
Non-Electrical Machinery	39.5	45.5	15.2
Electrical Machinery	63.7	83.6	31.2
Instruments	19.1	20.4	6.8
Miscellaneous Manufacturing	20.3	26.7	31.5
NON-MANUFACTURING			
Retail Trade	209.1	277.0	32.5
Wholesale Trade	74.1	95.8	29.3
Finance, Insurance & Real Estate	81.3	121.7	49.7
Medical and Health Services	46.9	83.9	76.8
Education	43.1	66.1	53.4
Miscellaneous Services	14.5	36.9	154.5

MANUFACTURING

Paper and Paper Products: Employment in this industry group is expected to grow by some 4300 employes, or approximately 26-percent, between 1963 and 1980. In 1963 industries producing converted paper and paperboard products (e.g., envelopes, wallpaper, and bags) and those producing paperboard containers and boxes accounted for 76.6 percent of all employment in this group. Growth in the Region's population and general business activity along with greater use of pre-packaging and replacement of metal with paper containers is likely to mean that these two industries will also account for a large share of the new employment.

Printing and Publishing: In 1963 this industry group accounted for seven-percent of the Region's manufacturing employment; in 1980 it will still account for nearly seven-percent. Within the Boston SMSA, it accounted for some ten-percent of all manufacturing employment in 1963.

Employment in printing and publishing is expected to rise by only 12-percent between 1963 and 1980, while output will rise by 35-percent. This rise in output per worker will result from the introduction of new technology and from higher levels of capitalization.

Approximately sixty-percent of this industry's employment is concentrated in newspaper printing and publishing, and commercial printing. All forms of commercial printing will expand greatly in coming decades as a result of increased business activity. The newspaper industry will maintain but not expand its current share of employment.

Leather Products: With a wide range of products from industrial belting to footwear and handbags, this industry group is expected to grow by 6500 employes, or 16.6 percent, between 1963 and 1980. Footwear, the group's major export industry, accounted for seventy-percent of its total employment in 1963 and will account for the majority of its employment growth.

Fabricated Metals: This group employed approximately five-percent of all manufacturing employes in 1963, and will employ slightly over seven-percent by 1980. The group will grow by some 11,600 employes before 1980, bringing total employment to around 45,700. Nearly 65-percent of this growth will take place in the group's national market-oriented industries. Thirty-six-percent of the export employment in 1963 was in cutlery, handtools and general hardware.

Non-Electrical Machinery: Employment in this

industry group will rise 15-percent between 1960 (39,500) and 1980 (45,500); as a result, the group will maintain its ten-percent share of manufacturing employment. The group's largest industry (special industry machinery, except metalworking machinery) accounted for 35-percent of its employment in 1963, and will continue to be the largest employer. Nearly 75-percent of the group's employes in 1963 were engaged in industries producing primarily for national markets. By 1980 over two-thirds will still be employed by export industries.

Because this group of industries produces the capital equipment used in the production of a wide range of goods and services, its growth is assured if the Region can remain competitive.(20)

Electrical Machinery: Since the early 1950's this industry group has in many respects been the backbone of the Region's manufacturing. In 1963 it employed 16-percent of all manufacturing employes, and by 1980 it will employ over 18-percent, or about 83,600 workers.

Within this primarily export group, the communications equipment industry is by far the largest employer, accounting for 61-percent of the group's total employment

---

(20) Office, computing, and accounting machines are among the products of this group.

in 1963. Other important components include: electric wiring and lighting equipment (12-percent) and electric transmission and distribution equipment (14-percent). Over ninety-percent of the group's employment was concentrated within the Boston and Lawrence-Haverhill SMSAs.

Instruments: While constituting only five-percent of the Region's total manufacturing employment in 1963, and projected to increase by less than seven-percent between 1963 and 1980, the Region's output in this group accounts for over five-percent of national output in this industry group. Its approximately 20,000 employes constitute a substantial drain upon the Region's supply of technical and scientific personnel.

All of the industries within this group produce primarily for national markets. The more important, in terms of 1963 employment, were those producing instruments for measuring, controlling and indicating physical characteristics (31-percent); engineering, laboratory, scientific and research instruments and associated equipment (17-percent) and watches, clocks, clockwork-operated devices and parts (14-percent).

Government expenditures on research and development and purchase of hardware are likely to continue to stimulate growth in this industry group. However, demand

Retail Trade: With Regional growth in population, employment, and real income, will come an expansion in retail trade. Growing slightly faster than total employment, retail trade will account for 23.7 percent of the Region's total employment by 1980. Department stores, grocery stores, and eating and trade establishments will continue to be the three largest industries in this group. Boston's share of the Region's retail trade can be expected to continue to decline.

Wholesale Trade: An increase of 21,000 employes (29-percent) between 1963 and 1980 will bring employment in wholesale trade to 95,800. The movement of wholesale trade out of the core cities in response to shifts in population and retail trade will continue.

Finance, Insurance and Real Estate: Employment in this important industry group is expected to grow by nearly fifty-percent between 1963 and 1980, bringing it to over ten-percent of all non-manufacturing employment. However, as a result of very rapid technological progress, especially in finance and insurance, gross output is projected to increase by nearly 100-percent by 1980.

Over fifty-percent of the total 1963 employment in this grouping was accounted for by three industries.

These were: commercial and stock savings banks (15,911); life insurance companies (15,171); and fire, marine and casualty insurance companies (13,189).

In 1963, 93-percent of all employment in this industry group was concentrated within the Boston SMSA. In 1980 some 91-percent will still be employed within the Boston SMSA.

Medical and Health Services: Growth in this industry group is expected to be the second most rapid among major non-manufacturing groups. Employing 46,900 workers in 1963, or 5.3 percent of all non-manufacturing employes, it is expected to grow 77-percent by 1980, when it will employ 82,900 workers, or 7.1 percent of all non-manufacturing employes. Again, employment is concentrated in the Boston SMSA. Eighty-five-percent of all employment in private hospitals, and 95.3 percent of all employment in medical and dental laboratories, was in the Boston SMSA in 1963.

Hospitals were the major employer in 1963 (66-percent) and will continue to be throughout the projection period. But significant growth is also anticipated in medical research laboratories, out-patient clinics, and rest and nursing homes. The President's Commission on Heart Disease, Cancer and Stroke recommended nearly a

doubling of annual expenditures to provide for projected medical needs. The subcommittee on facilities alone advised that an expenditure of approximately $12-billion would be necessary over a ten-year period. Among other things, these facilities would include regional heart, cancer, and stroke centers and specialized centers within existing or proposed research facilities.

Education: Employment in private education can be expected to increase by more than fifty-percent between 1963 and 1980, bringing the total to 66,100. While this is a high growth rate, employment in private education grew over eighty-percent in the 16-year period from 1947 to 1963. Over 93-percent of all employment in private education was located in the Boston SMSA in 1963; but this figure can be expected to decline.

Private education has been one of the Region's greatest attractions, responsible for the development of many of its most important growth industries. Other regions, however, are rapidly narrowing this competitive advantage.

Miscellaneous Services: Accounting for only 1.6 percent of all non-manufacturing employment in 1963, miscellaneous services is expected to employ 3.2 percent, or 37,000 workers, by 1980. This will be a growth of

150-percent, the fastest in the Region.

Over fifty-percent of all workers in this group are employed in the engineering and architectural services industry. A major portion of projected growth will occur in this industry, but the other two industries (accounting, auditing and bookkeeping services; and non-profit educational and scientific research agencies) will also grow rapidly.

VII

DEVELOPMENT OPPORTUNITIES

The Region stands to benefit from several organizational trends. One of these, a result of the rapid expansion in administrative responsibilities, is the increasing use of regional headquarters by firms located outside the Planning Area. Another is the increasing staff requirements of home offices, currently located in the region, especially among insurance firms. A third is the regionalization of warehousing and distribution.

Eventually the Region may benefit from the efforts now being made to persuade additional firms to locate their headquarters or a regional office in the Planning Area. Firms which operate internationally would find the Planning Area's location especially favorable. Technological advances which will permit smaller scale plants in some industries, such as steel, may also encourage growth of heavy manufacturing industries, now under-represented in the Planning Area.

New markets and industries are also ever-developing. Many of the new fields of development

which will be important by 1980 are already on the horizon. Among these are a number of scientific and technological fields which offer possibilities for economic growth in the Planning Area. These include: oceanographic exploration and research; transportation systems controls - highway, rail, rapid transit, air, and water; biomedicine; medical electronics and instrumentation; educational TV networks and other audio-visual systems; automation and data processing; chemistry; and nuclear desalinization and mineral extraction.

Oceanographic Exploration and Research: The Federal Program in oceanography calls for the expenditure of over $2-billion during the next ten years. Most of this expenditure will have an industrial impact since it will involve the development and production of prototype vessels, especially deep-submergence vessels for the Navy. The actual exploration of the world's oceans, their currents and topographies will require additional surface research vessels, telemetric devices and new kinds of electronic and communications equipment. Related meteorological research will require similar equipment.

Underwater mineral exploration and extraction will require the development of underwater housing and ancillary facilities, such as the Navy Sea Lab II or inflatable rubber housing. New fields of medical science will emerge, just as they have emerged from the space program.

Eight universities and scientific institutions in the Region have recently united to promote research, educational programs, and public interest in oceanography. Charter members include Boston College, Boston University, Massachusetts Institute of Technology, Northeastern University, University of Massachusetts, Marine Biological Laboratory, New England Aquarium, and Woods Hole Oceanographic Institute.

Firms in the Region have long been manufacturing special electronic equipment for use in this type of research. Three Greater Boston firms recently submitted a joint bid for the design and construction of two such craft for the Navy. But aggressive action will be necessary if competition from other metropolitan areas is to be met.

Medicine: The Planning Area, with its large number of outstanding medical teaching and research

institutions and laboratories, has much to gain by growth in the field of medicine. In 1964 national expenditures for medical and health-related research exclusive of construction of research facilities reached an estimated $1.7 billion, an increase of 15-percent over 1963. About 65-percent of all expenditures in this field are made by the Federal government. For fiscal 1965 Federal expenditures increased by some ten-percent. Of the nearly $1.1 billion spent by the Federal government in fiscal 1965, three-fourths supported work in non-Federal laboratories. Four-fifths of this allocation went to educational institutions and other non-profit organizations.

In 1963, hospitals spent nearly $3.7 billion on medical supplies including drugs, food, supplies and equipment. With the impetus of Medicare and the Heart Disease, Cancer and Stroke Act (PL 89-239), hospital and nursing home care can be expected to continue to grow rapidly.

Within the medical supply market exists enormous economic potential. Growth in electronic

equipment such as patient-sensing and monitoring devices, analytic instruments, closed circuit TV cyclotrons and medical computers can be expected. One estimate places the current medical electronics market at over $100-million, and this could grow to over $1-billion between 1970 and 1975.

The President's Commission on Heart Disease, Cancer and Stroke estimated needs for facilities for the entire health industry (i.e., schools of medicine, dentistry, public health, veterinary medicine, hospitals and research institutes) at around $12-billion over the next ten years. The Commission recommended an average annual appropriation during the next five years of $398-million in addition to currently scheduled programs in the fields of heart disease, cancer, stroke, and other research and rehabilitation. While the authorizations provided in the Heart Disease, Cancer and Stroke Act fall short of this, future appropriations are likely to be more in line with the recommendation.

The impact on the Planning Area of these appropriations for expansion of hospitals and educational and research facilities and for the reorganization of medical services will be considerable. And

even more important legislation for expansion of medical facilities can be expected in the future.

Transportation: Many new opportunities in the development of ground vehicles, ships and air vehicles are emerging. Over the next twenty years development of hydrofoil boats offers some promise of reducing transport costs, particularly in coastwise shipping, in inter-urban passenger transportation, and in intra-urban transportation for some metropolitan areas. For defense purposes, the future of the hydrofoil seems assured.

The vast requirements of modernizing and extending transit facilities in the nation's metropolitan areas offers immediate opportunities. Transit construction and equipment alone has been estimated at from one to three billion dollars annually. Opportunities for the Planning Area exist in meeting the growing demand for improved communications, radar, guidance and electronic warning and control devices. In fact, the entire field of transportation systems controls offers important opportunities for the Planning Area.

The development of supersonic jet transport and increased use by the military of VTOL aircraft also present opportunities for the Region.

Education: The anticipated growth in school enrollments will increase the demand for technological products to enrich instruction and to increase the efficiency of educators. Educational television can now offer several different audio-visual presentations simultaneously on a single channel. And development of television student response devices holds much promise. A large library of recorded presentations in each school or school system is likely to be commonplace in the not too-distant future. Teaching machines or programmed instruction equipment already have a sizable and rapidly growing market.

Automation and Data Processing: Tremendous growth in the size and scope of administration, in the number of technical and professional journals and in the amount of research being done has created a vast market for computers and data processing equipment to facilitate decision-making and record-keeping and to expedite information storage and retrieval. During the Seventies, investment in computers used for automated process control can be expected to rise ten-fold. Automated air traffic control and automated

rapid transit will be in use by 1970 along with automated libraries including automatic searching of legal information. Automation will be widely used for industrial decision-making, national planning, and language translation.

METHOD

Regional estimates for this study were made for five-year intervals to the year 2000. They included: gross product by industry, employment by industry, wages and salaries by industry, personal income and consumer expenditures.(1)

NATIONAL MARKET INDUSTRIES: GROSS PRODUCT

Independent projections of the Region's constant dollar gross product in 41 national market industry groups were made for five-year intervals from 1970 to 2000.

The general function was of the form: $Y=f(D,S)$, where Y=the Region's gross product in an export industry; D=national demand for the output of that export industry, defined as appropriate components of Gross National Product; and S=regional share of national output in the specific industry, defined

---

(1) See also "Method", Volume 1 of this study.

as $\frac{GP^{i}_{PA}}{GP^{i}_{US}}$, where i represents a comparable industry group. (2) This relationship was tested empirically for the period 1947 to 1963 using linear, log and mixed expressions to determine the specific equation which most significantly explained the Planning Area's output in each export industry. The final projections were derived using the specific expressions:

$$Y = a+b(D) + c(S), \text{ and}$$

$$\log Y = \log a + b(\log D) + \log c(S)$$

Demand Variable: Demand was defined as those components of GNP which were thought to be highly related to the level of output of the industry under consideration. The particular components to be applied to each industry were determined on the basis of material contained in _Resources in America's Future_, (3) the 1947 and 1958 United

---

(2) Acknowledgement is gratefully extended to Frederick Bell of the Federal Reserve Bank of Boston for specifying the particular expressions employed in the multiple regression analysis.

(3) Hans Landsberg, Leonard Fishman, Joseph Fisher, _Resources in America's Future_: _Patterns of Requirements and Availabilities, 1960-2000_. Baltimore, Maryland: (The John's Hopkins Press for Resources for the Future, Inc. 1963).

States inter-industry studies,(4) and other sources. The value of these demand components for the period 1947 to 1963 were then regressed with output in the particular industry to establish the best expression of the function.(5) For example, the Region's gross product in bakery products and in confectionary and related products were both regressed with the 1947 to 1963 values of U. S. consumer expenditures for food and soft beverages.

The projected values of the demand variables were obtained by applying Resources for the Future projections of each GNP component as a per cent of GNP for each projection year to this agency's adjusted estimates of GNP.

Share Variable: Each industry group was projected under two alternative assumptions concerning the Region's share of United States product. First, it was assumed that each regional export industry would maintain its 1963 share of national output throughout the projection period.

---

(4) Morris R. Goldman, Martin L. Marimont, and Beatrice N. Vaccara, "The Industry Structure of the United States: A Report on the 1958 Input-Output Study," Survey of Current Business, U.S.Dept. of Commerce, Office of Business Economics, November, 1964.

(5) Because several industries had the same demand variables, aggregations were made so that GP of only 41 industry groups were actually correlated with the independent variables. In all but a few cases the final relationships were significant at the 95 per cent level of confidence.

This means that each of the Region's industries must maintain a rate of growth at least equal to that for the industry nationally. Since 24 out of 41 national market-oriented industries in the Planning Area experienced a loss in share between 1947 and 1963, this seemed very optimistic.

The alternative assumption was that the Region's share over the projection period would reflect trends established between 1947 and 1963. Thus, for each national market-oriented industry group, share was regressed against time, and then projected on the basis of the relationship established.

"Share" was introduced as an independent variable in the equation primarily to isolate the relationship between the Region's product and the national demand, serving as a proxy for the many factors which influence the location of industry groups among regions. While there is a degree of circularity in introducing share as an independent variable, it was assumed that the Region's share is some function of wage rates, labor supply and quality, transportation, and so forth, and that the share variable is an appropriate proxy for this function. Incorporating multiple equations to specify these location factors was impossible within the time and funds available for this study.

Having projected values of gross product in each national market industry under alternative assumptions of share, it was then necessary to select that series which appeared most "reasonable". Judgments were made on the basis of historical data, industry studies of other regions and whatever other information could be brought to bear.

LOCAL MARKET INDUSTRY: GROSS PRODUCT

The gross product of each local market manufacturing group was projected by simple linear extension of the ratio of the Region's local market GP to its export GP for that particular industry group. There were two exceptions to this: (1) the GP estimate for the local component to the printing and publishing industry was derived by regressing GP in this group against a combined total manufacturing export GP and total non-manufacturing GP, and (2) the GP estimate for the local component of transportation equipment was derived by regressing local GP in this industry with the Planning Area's population.

The Region's total local market non-manufacturing GP was estimated by projecting the ratio of local

market non-manufacturing GP to national market non-manufacturing GP. This projected ratio was then applied to the projected national market output. The distribution among local market non-manufacturing groups was made on the basis of each group's projected share of total local market non-manufacturing GP. For several industries, the projected share of total local market GP appeared so large as to raise questions of reasonableness. In these cases, simple correlations were established between GP in the particular industry group and estimated of population in the Planning Area or estimates of GP in one or more other industries (local and/or export). Determination re linkage with other industries was based on U. S. 1958 inter-industry study.(6) Necessary adjustments were made in the shares attributed to other industries in order to maintain the non-manufacturing local market GRP control total.

---

(6) U. S. Department of Commerce, Office of Business Economics, "The Transactions Table of the 1958 Input-Output Study", Survey of Current Business, September, 1965, U. S. Government Printing Office, Washington, D. C.

EMPLOYMENT

Employment estimates were derived by dividing the Region's projected gross product in each industry group by projected values of gross product per worker in that industry group. In general, it was assumed that past trends in the Region's output per worker would continue over the projection period. In instances where the linear projections appeared to give unreasonable results, adjustments were made. Since rapid growth in output per worker was projected for most industries, both national market and local market employment is projected to rise at a somewhat slower rate than gross product.

WAGES AND SALARIES

Wages and Salaries for each industry group were estimated on the basis of the projected ratio of wages and salaries to GP. These estimates were adjusted for general reasonableness, but were not given detailed attention since they play a relatively minor role in the study.

Personal Income: Time and data limitations precluded deriving personal income projections by source. Instead, the relationship between constant

dollar Gross Regional Product and constant dollar personal income was established historically and this relationship was extended through the projection period.(7) Projection on the basis of the historical relationship between wages and salaries and personal income yielded unsatisfactory results since personal income became greater than GRP. This apparently resulted from the very substantial rise in labor's share of output between 1947 and 1963. Projecting this historical trend apparently produced a significant overstatement of the wage bill, and hence of personal income.

INCOME DISTRIBUTION

A graphical method put forth by David Durand in "A Simple Method for Estimating the Size Distribution of a Given Aggregate Income", Review of Economic Statistics, November 1943, was used to

---

(7) The relationship established between personal income and Gross Regional Product does not appear unreasonable in light of similar relationships found in other regional studies, notably the State of Maryland, the Elgin-Dundee area in Illinois and Sioux City, Iowa. See Charles Leven, "Regional Income and Product Accounts: Construction and Application", Design of Regional Accounts, Resources for the Future, Inc., Baltimore, 1963, and John W. Kendrick and C. Milton Jaycox, "The Concept and Estimation of Gross State Product", Southern Economic Journal, Volume 32, October, 1965.

project the distribution of income. The major assumption underlying this method is that the Lorenz curve will remain unchanged. A Lorenz curve is a graphic device indicating the distribution of income among the spending units of a specific geographic area. An absolutely equal distribution of income would be represented by a straight line inclined at an angle of 45 degrees. In this case, one-tenth of the total spending units (families) would receive one-tenth of the total family income, etc. The greater the departure from equality, the more widely will the curve of cumulative relative frequencies depart from the line of equal distribution.

The projections assume that each income group will share equally in the rise in mean income. Thus, an increase by $1 + \frac{1}{a}$ in mean income will result in a decline of $\frac{a}{a + 1}$ in the proportion of population making less than X dollars under the old distribution. The cumulative income distribution for the population in a base year, and the rate of increase in mean income for the period are needed to make the projections.

The income distributions used as a base for the projections were taken from the U. S. Census of Population; 1960 as reported for "families" and "primary individuals" in the Boston SMSA.(8) The unrelated individuals in the $10,000 and over class as reported for the Boston SMSA (Table 135) were distributed into $10,000 - $14,999 and $15,000 and over classes on the basis of the distribution for the State (Table 65).

The projected increase in mean income was derived from the Metropolitan Area Planning Council's Economic Base and Population Study for the region. In order to achieve comparability between Census data and Economic Base mean cash income estimates, the latter were adjusted downward to the Census mean by the ratio of the 1960 Census mean to the total regional cash income mean.

---

(8) U. S. Bureau of the Census, U. S. Census of Population: 1960 Vol. I, Characteristics of the Population, Part 23, Massachusetts. Tables 76 and 135.

The calculated percentage increase in mean income for the region is as follows:

1960-1970	34.13
1970-1975	15.60
1975-1980	14.01
1980-1985	10.61
1985-1990	10.49

The projected percentage increase in adjusted mean income for the Region was then applied by the Durand technique to the 1960 distribution of families and unrelated individuals for each five-year period to obtain income distributions for the Planning Area in 1975 and 1990.

Other Approaches: Several attempts were made at fitting historical income distributions to frequency functions of the distributions prior to the decision to use the graphic method described above.

Income distributions were constructed for nine Postwar years, the frequency distributions computed, and the points fitted to a quadratic frequency function. The frequency function of the income distributions were all bell-shaped with a maximum value very close to the mean income for the population. The distribution curve was described by considering the percentage of

the population in an income class at the midpoint of the class. The percentage of population in an income class was then considered to be a function of the distance of the midpoint of the income class from the mean.

The specific form of the function was a log-log quadratic. First the percentage of population in each income class were transformed into logs, then the distance of the midpoints of the income classes from the mean income for the population were transformed into logs. Then the log of the distance of the midpoint of the income class from the mean was squared. Thus, the form of the function to be fitted was $\log P = a + b(\log D) + c(\log D)^2$.

The income distribution has some inherent properties which need to be considered. The income distribution is restricted to values greater than zero and the sum of all the percentages of the classes must equal one hundred per cent. Thus, the higher the mean income the lower will be the maximum percentage in the class containing the mean. We would expect a general flattening of the frequency function as the mean income increases, and this expectation is verified by the historical data.

In an attempt to flatten the curve an additional term was added to the frequency function to correct for the shift in the mean. This term is the log of the mean income. Thus the full frequency function fitted to the historical data was:

$$\text{Log } P = a + b(\log D) + c(\log D)^2 + d(\log y)$$

The above function fitted the data very well; the table of analysis of variance is shown below with the coefficients.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
X_2, X_3, & X_4	80.19454	3	26.73151
residual	12.73562	113	.11270
Total	92.93016	116	

R_2 = .86295   F = 237.192 $F(3/113)_{.99} = 3.98$

$$P^* = 1.21080_i - .09847D^*_i - .17220D^{*2} + .93064Y^*_i$$

where the * indicates a log value.

The tests of "goodness of fit" were encouraging but the sign on the last term would be expected to be negative, not position. But in the quadratic, as opposed to the log quadratic, both coefficients are negative and the roots of the quadratic are imaginary.

For all this encouragement, both of the projected income distributions had some unacceptable characteristics. First, the cumulative frequency for all classes is considerably greater than 100 per cent, and the percentage in the mean class shows the unexpected tendency to rise. These two characteristics led us to believe that the projections of the income distribution on the basis of the historical frequency function were unacceptable, and thus are not presented.

One more attempt was made to statistically fit a frequency function to the historical cumulative income distribution by using a log-reciprocal transformation. The fit of this function to the data was poor, $R^2 = .45464$, with .95 significance for $n = 9$, $R^2 = .6021$, $F = 5.83589$, with $F\ (1/7)_{.99} = 5.59$ and $F\ (1/7)_{.99} = 12.25$.

Fits of this significance were considered unworthy of further efforts at projections over a 30-year period with a projected 93 per cent rise in average family income. Neither of the above methods of fitting and projecting the income distribution statistically gave satisfactory results.

CONSUMER EXPENDITURES

Projections of consumer expenditures revolved around judgments as to whether the distribution of expenditures in the P.A. would bear the same relationship to the U. S. per cent distribution as it has in the past, whether the Region's distribution would move toward U. S. averages, or whether the deviations would become more pronounced. The assumptions used and the national expenditure pattern they were applied to were taken from Resources in America's Future.

In estimating the dollar amounts of projected consumer expenditures, it was assumed that the trend in the proportion of personal income going to taxes and savings would continue.

ECONOMIC BASE AND POPULATION STUDY
for
EASTERN MASSACHUSETTS

VOLUME II

Prospects for Economic Growth

prepared by the
METROPOLITAN AREA PLANNING COUNCIL

BOSTON PUBLIC LIBRARY
3 9999 00379 901 0

1231373837
HC107.M4A548/V2
A PLANNING

DO NOT REMOVE THIS
CARD FROM THE BOOK POCKET
A FINE OF 10 CENTS WILL BE
CHARGED FOR LOSS OF THIS CARD.

Boston Public Library
Copley Square
General Library

HC107
.M4A548
V2
1231373837

The Date Due Card in the pocket indicates the date on or before which this book should be returned to the Library. Please do not remove cards from this pocket.